

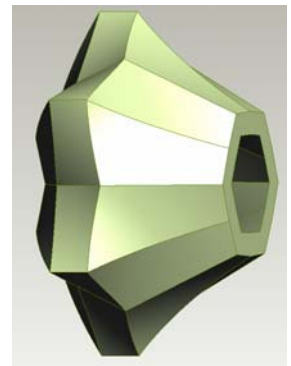
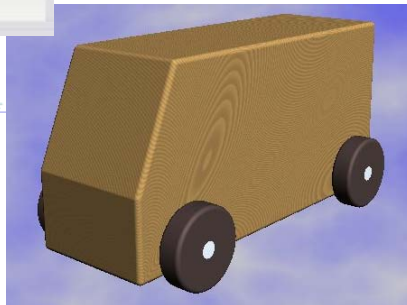
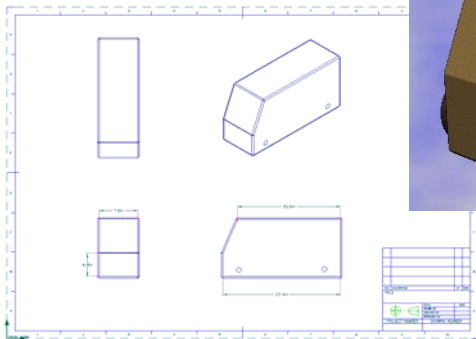
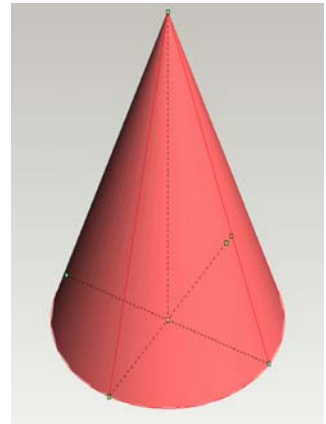
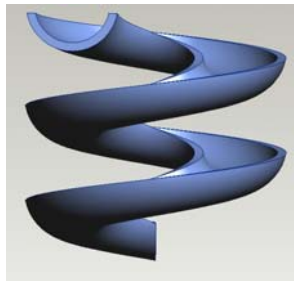
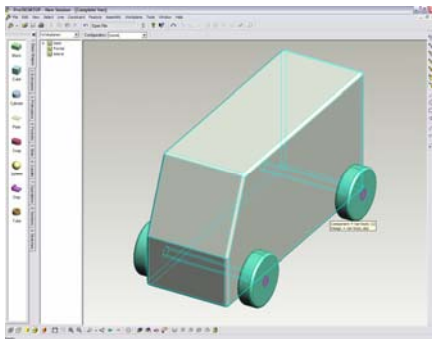
3-D Solid Modeling and Design

Student Learning Activities
for

PTC

Pro/DESKTOP® 8.0

Activity #4



Activity 4:

“Cylinders, Chamfers, and Constraints”

(Flesch-Kincaid readability level = 6.0)

About the program

Pro/Desktop (called ‘PD’ from now on) is a powerful software program that allows you to sketch ideas first, and then work on design details later.

This activity will help you:

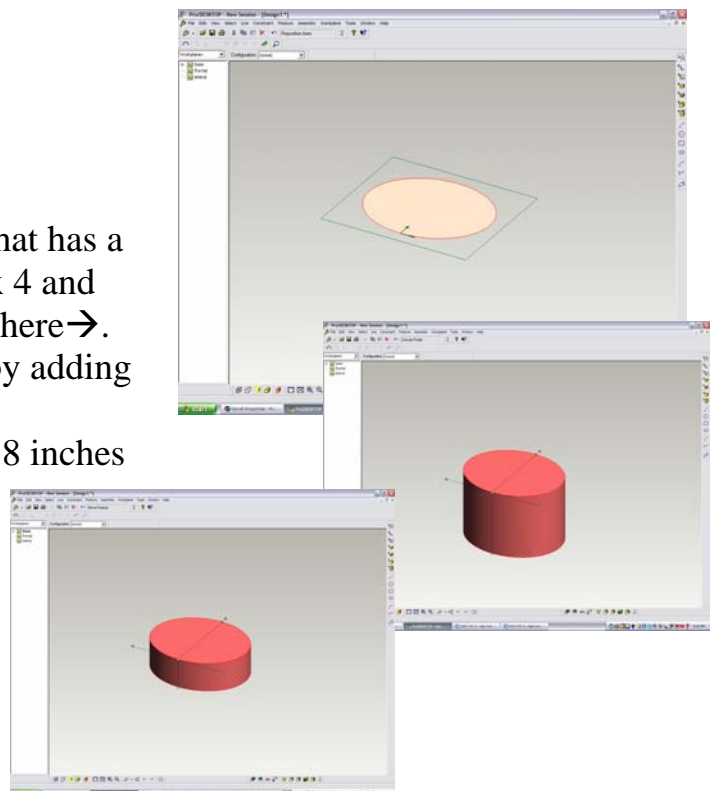
- Memorize additional icons and their functions that you use to move and shape designs
- Use constraints for structure and also flexibility in your designs.


User Terms:

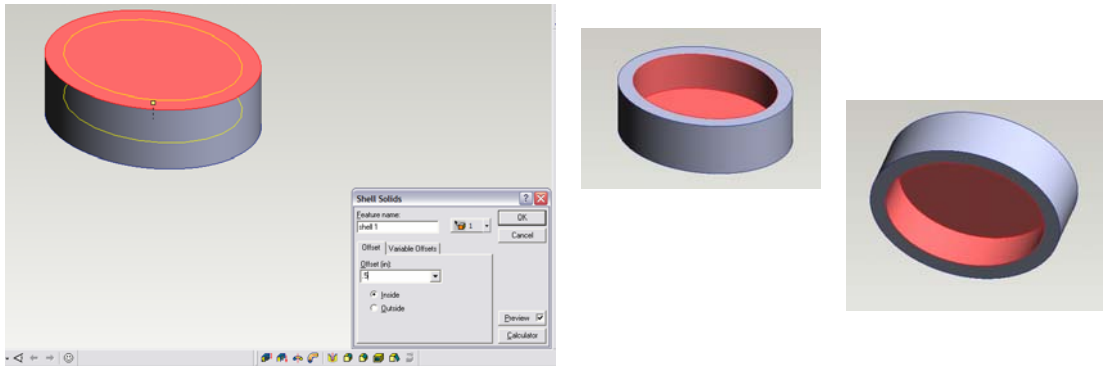
- Diameter
- Cylinder
- Features Toolbar Icons
- Top Toolbar Icons
- Perpendicular Constraint
- Parallel Constraint
- Equal Length Constraint

Round and round we go....

Open a new design. Draw an ellipse that has a dimension (size) of approximately 6 x 4 and reposition the Point of Origin as seen here→. Extrude the ellipse to a Z dimension by adding 3 inches BELOW the workplane. Reduce the Z axis to approximately 1.8 inches (remember, Z is now BELOW the workplane).

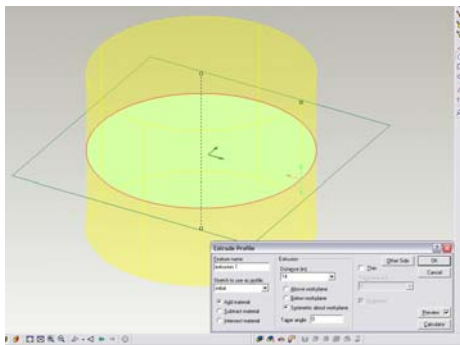


Click on the 'Select Face' icon and click the top surface. In the Features Toolbar, select the Shell Solids icon . This command will 'hollow out' or turn a solid design into a 'shell'. In the dialogue box, enter the Offset at .5 inches and click 'OK' (you can also click and drag on the small yellow **handle** (square) to the correct size). Rotate the 'Shell' of your original ellipse with the keyboard keys to see it from various angles. **Do not save this design.**




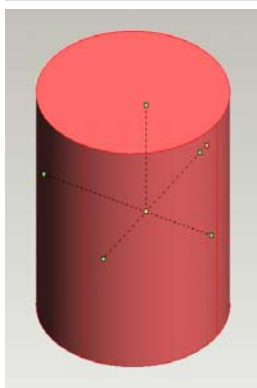
Begin a new design. Draw a circle that has a **diameter** (the symbol for diameter is Ø) of 18". Reset the view to Half Scale. Extrude the circle to a Z dimension of 14 inches of added material SYMMETRIC ABOUT THE WORKPLANE. Click OK.

We want to increase the Z axis to 38 inches above the profile, but if we click and drag, the mouse may go off the screen before you even get close to 38 inches. Instead, click on the design to make it active (**red**). **DOUBLE CLICK**



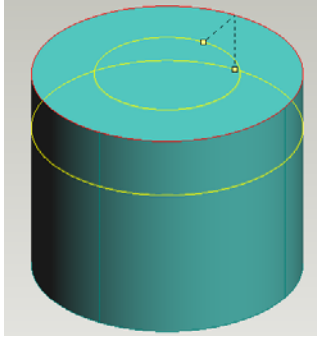
the green handle at the top end of the z axis. In the dialogue box, enter a distance of 38. Nothing happened!


Did you notice the Upgrade icon () became colored? Click it and your design will update the new size. The Update icon 'updates' newly applied features to your design. Increase (x,y) to 34.5 x 34.5 by



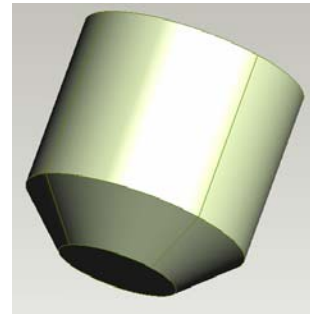
clicking and dragging any (x,y) **green** handle. If you cannot get to .5 or smaller decimals, zoom in on the design and you can drag to more precise measurements. Click Autoscale.

Save your design according to your instructor's directions.

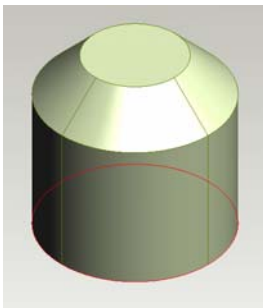


You are going to change the edges of the newly designed **cylinder** (a circular rod, pipe, or hole that has length to it). Instead of a round, you will use the **chamfer** icon () which makes a flat edge instead of a rounded one. Click the Select Edge icon then click on the top edge of the cylinder so that it turns **red**. Select the Chamfer icon. In the dialogue box under the 'Chamfer' column, click on the 'Angle setback' radio button. In the 'Setback s (in)' field, type in the number '8' and 'Angle a' should be 45 (degrees). Look at the preview on the screen to see if it looks like the picture above.

Now click 'OK'. Rotate the new design around & take a look at what the Chamfer looks like.



Press the **Home** key to return to the default view. Click again on the Select Edge icon and select the **BOTTOM** edge of the cylinder. Select Chamfer. This time, check the 'Unequal setback' radio button. Enter 'Setback s' as 10 and 'Setback S' as 19. Click OK. Rotate the design and look at what this chamfer has done to the cylinder.

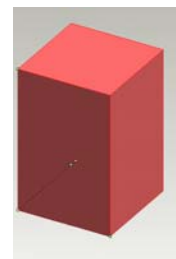
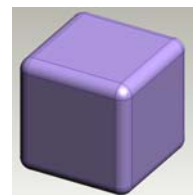


Press the **Home** key when finished.

Save your design according to your instructor's directions.


I feel unconstrained!

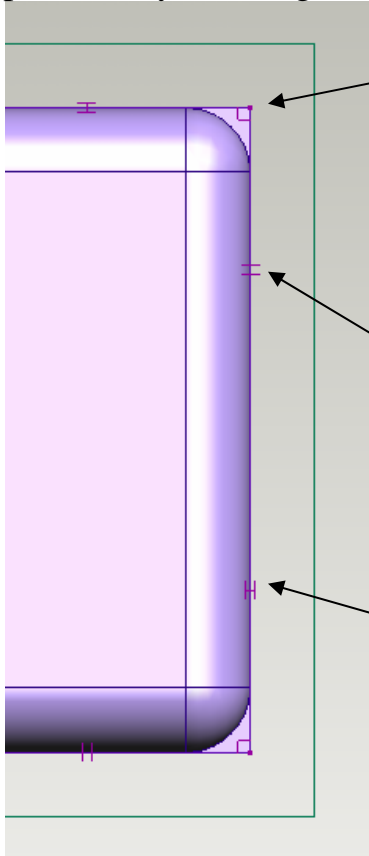
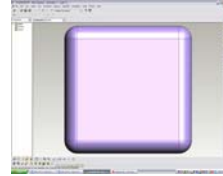
Open the cube with rounded edges you designed in Activity 3. → We are going to reshape the square sides into a rectangle. Click on the 'Select Features' icon and click on any inside square of the cube so that the small **handles** appear at the end of each axis. Try to drag either the *x* or the *y* handle to a length of 6.5 (inches). What happens to the other axis *x* or *y*? It moves as well. Click 'Undo'. The reason you cannot move the lines separately is because they are **constrained**. If you remember



from Activity 2, when something is **constrained**, it has had limits placed upon what can and cannot be done to it. You must remove the constraint that makes the x and y axes move together. Exit this design and **DO NOT SAVE**.

Open the square with rounded edges from Activity 3 and set it to the Workplane view. →

Click on the 'Select Constraints' icon (). When you do, the original Design Field will show up, and so will some small 'tick' marks. These marks represent what constraints have been placed on your design. They are:



Perpendicular Constraint:

(This constraint makes these 2 lines that form this corner ALWAYS meet at a 90-degree angle. This corner cannot be modified to be anything less or more than 90 degrees while this constraint is active)

Parallel Constraint

(This constraint makes this line and the one opposite of it always parallel. These two lines cannot be changed from being parallel while this constraint is active)


Equal Length Constraint

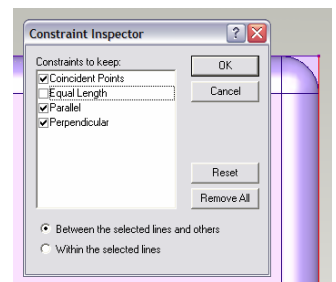
(This constraint makes all features maintain an equal length should one feature be changed. For example, if an x axis is changed, the y axis would change by the same amount while this constraint is active)

Which constraint would you choose to de-activate to make x and y different lengths? That's right: We are going to turn off the Equal Length constraint.

Click on the 'Straight' line icon in the Design Toolbar. When you do, the Constraints will disappear. Press the **Esc** key.

Now click on the right side of the rectangle so that the line shows **red**. In the Top Toolbar, the **Constraint Inspector**


Icon () becomes active. Click on it. The Constraint Inspector dialogue box appears and shows a list of the



constraints active in your design. Un-check the 'Equal Length' box. Click OK.

Do this same procedure for the opposite (left) edge of the square.

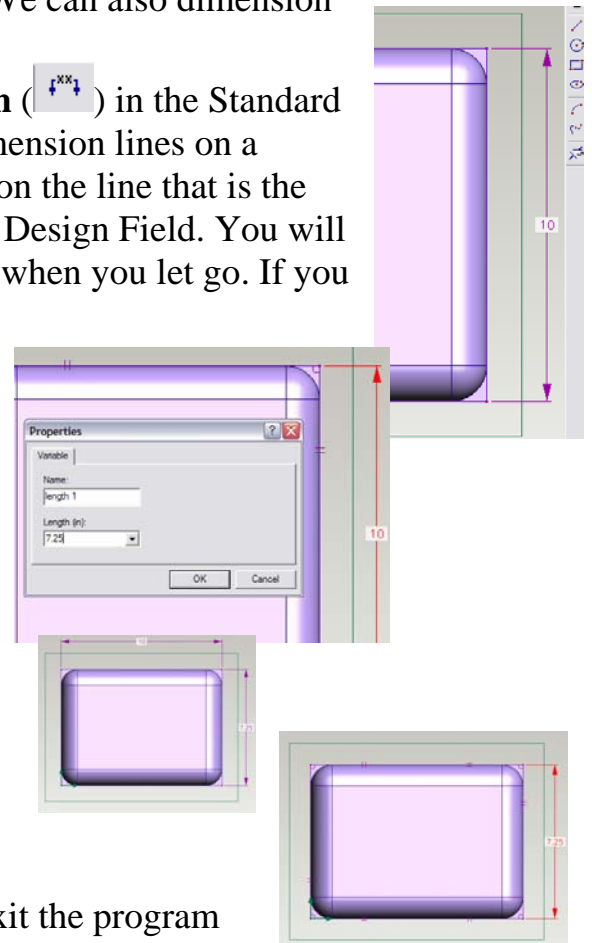
The Equal Length Constraint is now gone and we can change the sizes of x and y to any shape independent of each other. We can also dimension the design at the same time.

To do this, click on the **Sketch Dimension icon** () in the Standard Toolbar. This icon allows the user to place dimension lines on a design or drawing. Now **click and hold down** on the line that is the right edge of the square. Drag outward into the Design Field. You will see a dimension of 10 (inches) appear and stay when you let go. If you make a mistake, click 'Undo'.

Now, double-click on the number '10'. Enter the number '7.25' in the dialogue box that appears and click OK. Click the 'Update' icon. With the constraints turned off, you can either click the dimension and enter the new value in the dialogue box, or you can click and drag the axis handles. Now, see if you can add the dimension across the top.

SAVE your design at this point according to your instructor's directions.

You have completed this activity using PD! Exit the program and complete the following matching assignment on a separate sheet of paper.



Student name: _____ Student Number: _____






Class

period: _____ Date: _____ Teacher: _____

STUDENT WORKSHEET Pro/DESKTOP 3-D Modeling Software

Activity 4: “Cylinders, Chamfers, and Constraints”

Directions: Write the letter of the most correct definition of the icons used in this activity in the space provided:

Term or Icon	Name and Definition
___1. Equal Length Constraint	a) Shell Solids = This command will ‘hollow out’ or turn a solid design into a ‘shell’.
___2. Ø	b) The symbol for diameter.
___3. Cylinder	c) This constraint makes all features maintain an equal length should one feature be changed. For example, if an x axis is changed, the y axis would change by the same amount while this constraint is active.
___4. 	d) A circular rod, pipe, or hole that has length to it.
___5. 	e) Update = ‘Updates’ newly applied features to your design.
___6. 	f) This constraint makes this line and the one opposite of it always parallel. These two lines cannot be changed from being parallel while this constraint is active.
___7. 	g) Constraints Inspector = Shows a list of the constraints active in your design.
___8. 	h) Sketch Dimension = Allows the user to place dimension lines on a design or drawing.
___9 Perpendicular Constraint	i) Chamfer Edge = Makes a flat edge instead of a rounded one.
___10. Parallel Constraint	j) This constraint makes these 2 lines that form this corner ALWAYS meet at a 90-degree angle. This corner cannot be modified to be anything less or more than 90 degrees while this constraint is active.